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ARTICLE

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PHAGE THERAPY: THE ULTIMATE ALTERNATIVE AGAINST ANTIBIOTIC RESISTANCE (ABR) - CHALLENGES, ADVANTAGES, OPPORTUNITIES AND THE PIVOTAL ROLE OF DNA-BINDING PROTEINS IN STEERING MODERN STRATEGIES THROUGH LYTIC-LYSOGENIC CONTROL

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The relentless rise of antibiotic resistance (ABR) presents a grave threat to global health, steadily diminishing the effectiveness of conventional antibiotics against once-manageable infections. In 2023 alone, nearly two million lives were lost to antibiotic-resistant infections, with projections warning of a 70% increase in fatalities by 2050. This alarming trend underscores the urgent need for alternative therapeutic strategies.

In this review, we explore phage therapy as a promising solution. Although discovered long before antibiotics, early phage therapy efforts were hampered by limited scientific understanding, inadequate documentation, and challenges in application. However, today's advancements in genomics, molecular biology, and phage engineering have breathed new life into this strategy, paving the way for more effective therapeutic use.

Central to these innovations are the DNA-binding proteins within bacteriophages, which regulate the switch between lytic and lysogenic cycles, redefining phage-based treatments. Deciphering these proteins unlocks new therapeutic avenues, enabling precise control of phage life cycles to optimize bacterial eradication. Additionally, engineered phages offer the potential to deliver CRISPR-Cas systems, facilitating targeted gene editing to disable resistance genes or reduce bacterial virulence.

By harnessing the full potential of modern phage therapy, we stand at the brink of a revolution in precision medicine, equipped to outpace the adaptive evolution of ABR pathogens and restore control over drug-resistant infections.